Attachment A
Aggregation Scheme in v.2.1.6

While all grid-connected existing and planned/committed electric generating units in the lower continental U.S. are represented in v.2.1.6, an aggregation scheme is used to cluster real life units into model plants, and IPM uses the model plants in the actual modeling. The aggregation scheme serves to reduce the size of the model and makes the model manageable while capturing the essential characteristics of the generating units.

Table A-1 provides a crosswalk between actual plants and model plants in v.2.1.6. For each plant type, the table shows the number of real plants and the number of model plants representing these real plants in v.2.1.6. (This is an update of Table 4.7 that appears in *Documentation of EPA Modeling Applications (V.2.1) Using the Integrated Planning Model*.).

The aggregation scheme also defines groups of states across which generating units can be aggregated. Attempts are made to define these state groups in a way to support emissions analyses that seem most likely to be requested in the future. Table A-2 and an accompanying map show the geographical aggregation scheme used in v.2.1.6.

Table A-1 Aggregation Profile for Model Plants As Provided in Set Up of EPA Base Case, v.2.1.6

Existing Units*		
Plant Type	**Number of Units**	**Number of IPM model Plants**
Coal Steam	1,293	696
Oil/Gas Steam	856	224
Combined Cycle	860	190
Turbine	5,021	319
Integrated Gas Combined Cycle	3	3
Nuclear**	104	103
Hydro	3,889	24
Pumped Storage	142	17
Biomass	130	30
Wind	192	22
Fuel Cell	10	3
Solar	27	5
Geothermal	202	4
Landfill Gas	129	21
Fossil Waste	9	8
Non-Fossil Waste	126	34
Total	**12,993**	**1,703**

Retrofits		
	Number of Units	**Number of IPM model Plants**
Coal To Scrubber Retrofit	---	493
Retrofit Coal to Scrubber+SCR	---	1120
Retrofit Coal to Scrubber+SNCR	---	458
Retrofit Coal to Gas Reburn	---	—
Retrofit Coal to Gas Reburn + Scrubber	---	---
Retrofit Coal to Selective Catalytic Reduction (SCR)	---	323
Retrofit Coal to Selective Noncatalytic Reduction (SNCR)	---	291
Retrofit Coal to Activated Carbon Injection (ACI)	---	927
Retrofit Coal to ACI + SCR	---	444
Retrofit Coal to ACI + SNCR	---	457
Retrofit Coal to ACI+Scrubber	---	969
Retrofit Coal to ACI+Scrubber+SCR	---	736
Retrofit Coal to ACI+Scrubber+SNCR	---	287
Retrofit Oil and Gas to SCR	---	202
Retrofit Oil and Gas to SNCR	---	202
Retrofit Nuclear -- 10 year extension at age 30	---	---
Retrofit Nuclear -- 20 year extension at age 40	---	---
Retrofit Nuclear -- 10 and 20 year extensions	---	---
Total	**---**	**6,909**

New Units		
Conventional Pulverized Coal	---	72
IGCC	---	72
Combined Cycle	---	74
Combustion Turbine	---	74
Advanced Combustion Turbine	---	74
Advanced Nuclear	---	78
Biomass	---	26
Wind	---	132
Fuel Cells	---	54
Solar Photovoltaics	---	26
Solar Thermal	---	11
Geothermal	---	14
Landfill Gas	---	**24**
Total	---	**731**

Repowerings		
Coal to Combined Cycle repowering	---	568
Coal to IGCC repowering	---	568
Oil and Gas to Combined Cycle repowering	---	224
Total	---	**1,360**

Early Retirements		
Coal Early Retirement	---	696
Oil and Gas Early Retirement	---	224
Combined Cycle Early Retirement	---	190
Combustion Turbine Early Retirement	---	319
Nuclear Early Retirement	---	103
Total	---	**1,532**

Grand Total (Existing + New + Retrofits + Repowerings + Early Retirements): 12,235

Notes
*IPM plants with total capacity of #0.5 MW were not included in v.2.1.6.
**All nuclear generating units, except Browns Ferry units 1 and 2 are represented by a separate model plant. In the v.2.1.6 base case, Browns Ferry Unit 1, which is projected to be brought out of mothballs, is represented by the same model plant as Browns Ferry Unit 2.

Table A-2. Geographical Aggregation Scheme in EPA-IPM v2.1.6

The v.2.1.6 aggregation offers the capability to model separate emission limits in WRAP trading and non-trading states, East and West Clear Skies regions, NO_X trading regions, the NO_X SIP Call region as a whole, and OTC. It also supports the ability to model emission limits in a potential six regional planning organizations (RPOs): West (coincides with WRAP) Central (also called CenSARA and CENRAP), Midwest (also called LADCO), NESCAUM, Northeast (NESCAUM + PA, MD, DE and DC), and Southeast. This aggregation scheme also separates out Texas, Connecticut, and New Hampshire to represent existing state emission caps; and Kansas and Oklahoma to allow their inclusion in either the Clear Skies East or West regions; and Wisconsin to allow for possible changes in the SIP call region. Missouri is also separate so that it can be included in both the SIP Call and in the Central RPO.

When aggregated into model plants, units cannot be from more than one of the 26 electric dispatch model regions and from more than one of the following regions.			
No.	**Region Name**	**Reason for differentiation**	**States Included**
Major Groups			
1	SIP Call - NESCAUM	When combined with the Northeast Border states and Connecticut allows NESCAUM to be broken out.	MA,NJ,NY,RI
2	SIP Call - Non-NESCAUM OTC without Virginia	When combined with "SIP Call - NESCAUM" and Virginia allows the OTC to be broken out.	DC,DE,MD,PA
3	SIP Call - Virginia	Allows Virginia to be included in the SIP Call, OTC, and the Southeast RPO.	VA
4	SIP Call - LADCO	When combined with Wisconsin allows LADCO to be broken out.	IN,IL,MI,OH
5	SIP Call - Missouri[1]	Allows Missouri to be included in both the SIP Call and in the Central (CenSARA) RPO	MO
6	SIP Call - South[2]	When combined with Florida, Mississippi, and Virginia allows the Southeast RPO to be broken out	AL,GA,KY,NC,SC,TN, WV
7	WRAP Nontrading States	To differentiate WRAP states with and without expressed interest in trading	WA,MT,ND,SD
8	WRAP Trading States		OR,ID,WY,CA,NV,UT, CO,AZ,NM
9	Connecticut	To capture existing emission policies	CT
10	New Hampshire		NH
11	Border States - Northeast	To cluster states not anticipated to require separate differentiated analysis of emission limits into the largest possible groups of contiguous states.	ME,VT
12	Border States - South Central		AR,LA
13	Border States - Midwest		IA,MN

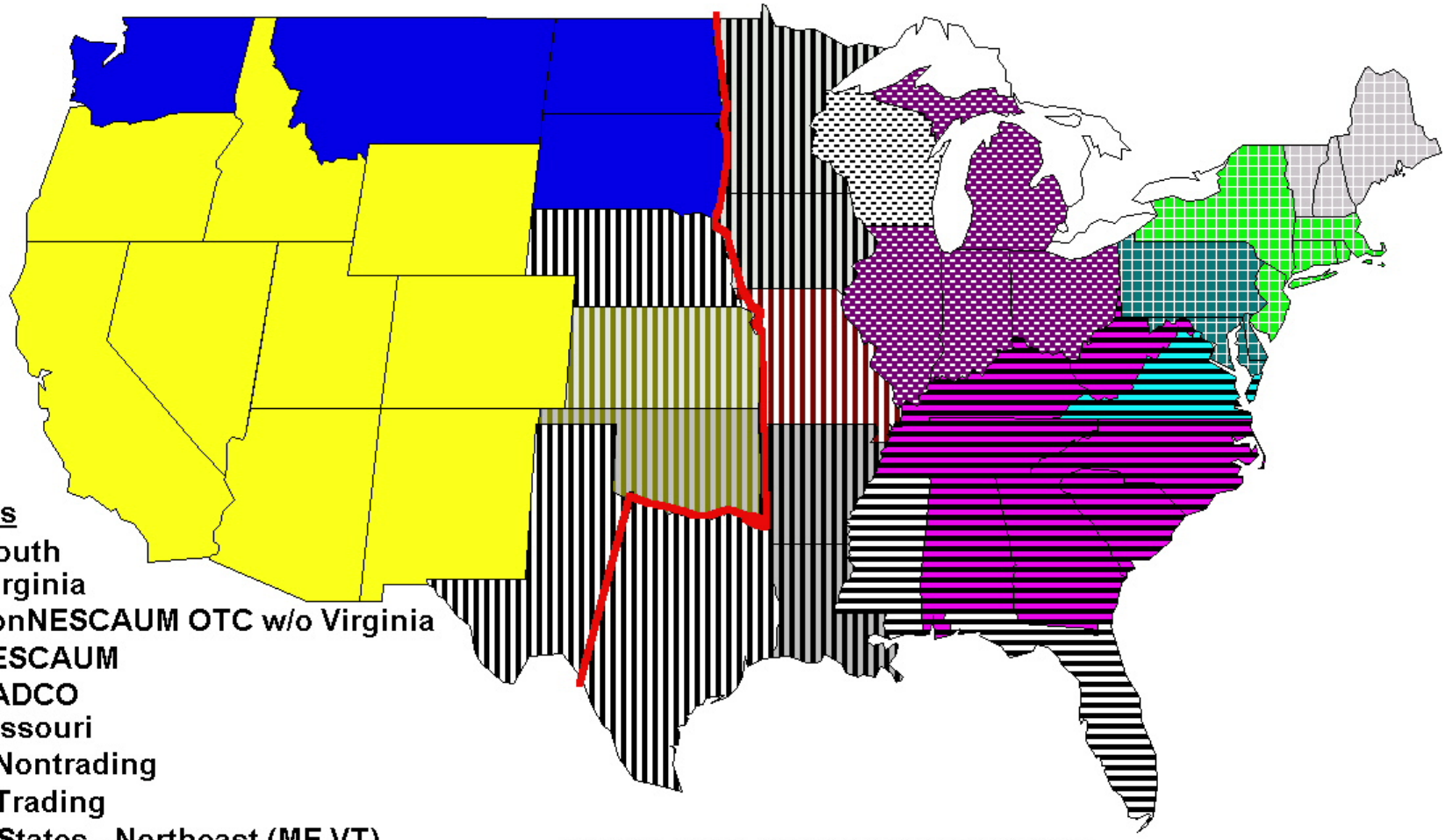
Other			
14	Texas - East	To support the East/West NO_X trading zones in Clear Skies	TX - East of Interstate 35
15	Texas - West		TX - West of Interstate 35
16	Wisconsin	To retain the option of analyzing Wisconsin both in and out of the SIP Call.	WI
17	Nebraska	Nebraska is not in the WRAP, but must be analyzed with the WRAP states and Texas - West when analyzing the NO_X West trading zone for Clear Skies.	NE
18	Florida	Is not in SIP Call region so must be treated separately.	FL
19	Mississippi	Is not in SIP Call or in Central RPO so cannot be lumped in with them, but must be treated separately.	MS
20	Oklahoma	Allows inclusion of these states in the Clear Skies Initiative West region.	OK
21	Kansas		KS

Notes

[1]Since generating units in eastern Missouri are already captured separately as part of the IPM model region MANO, the model is already equipped to analyze possible future scenarios that include eastern Missouri in the SIP Call Region. Such a scenario is part of a recent EPA rulemaking proposal.

[2]Though not currently included in the SIP Call, Georgia is aggregated with states in the "SIP Call - South" subregion because Georgia is requiring power plants in th northern part of the state to install controls which are comparable to the controls under the SIP Call. In addition, including Georgia in the "SIP Call - South" subregion equips IPM to analyze possible future scenarios that may arise out of a recent EPA rulemaking proposal which includes northern Georgia in the SIP Call region. It also avoids the complexity of having to create a separate subregion just for the south part of Georgia.

Geographical Aggregation Scheme in IPM v. 2.1.6



Major Groups

- SIP - South
- SIP - Virginia
- SIP - NonNESCAUM OTC w/o Virginia
- SIP - NESCAUM
- SIP - LADCO
- SIP - Missouri
- WRAP Nontrading
- WRAP Trading
- Border States - Northeast (ME,VT)
- Border States - South Central (AR,LA)
- Border States - Midwest (IA,MN)

Regional Planning Organizations

- West (WRAP Nontrading and Trading)
- Central (NE,KS,OK,TX,MN,IA,MO,AR,LA)
- Midwest (IL,IN,MI,OH,WI)
- Southeast (SIP - South + FL,MS,VA)
- Northeast (CT,DC,DE,MA,MD, ME,NH,NJ,NY,PA,RI,VT)

Others (with reasons for separation)

Texas - East (Clear Skies)
Texas - West (Clear Skies)
Oklahoma and Kansas (Enable inclusion in Clear Skies West)
Wisconsin (Option to be in or out of SIP Call)
Nebraska (in Clear Skies West; not in WRAP)
Florida (Not in SIP Call)
Mississippi (Not in Central RPO or SIP Call)
Connecticut and New Hampshire (to capture state regulations)

Border Between Clear Skies East and West